Transportation Communications Interoperability:
Phase 2 – Resource Evaluation

BACKGROUND

Arizona Department of Transportation (ADOT) research project SPR 561 (*Transportation Communications Interoperability: Phase 1 - Needs Assessment)* provided a road map to better radio communications for ADOT and its core partners in the State, primarily the ADOT Motor Vehicle Division (MVD) and the Department of Public Safety (DPS). Five pilot projects were proposed, of which three were solely internal ADOT actions. However, Pilot Projects 4 and 5 required external support and guidance to be implemented. These involved interoperability between ADOT field workers and DPS Highway Patrol officers on the State's rural highways.

DPS operates UHF (ultra high frequency) radios. Pilot Project 4 would add secondary VHF (very high frequency) mobile radios in a small number of DPS patrol cars, to communicate directly with ADOT on its statewide VHF radio network. Pilot Project 5 would test console inter-ties between the DPS Flagstaff and Tucson Operational Communications dispatch centers (OpCom) and the ADOT Traffic Operations Center (TOC), so as to link ADOT channels and DPS channels together over the entire State.

To carry out the two recommended pilot projects in the field would require significant funding to provide VHF-band mobile radios for DPS patrol cars on a full-squad basis, and for the dispatch console inter-tie hardware and programming, all in addition to the significant cost of performing the interoperability evaluation itself. Although some DPS supervisors previously had surplus VHF radios in their patrol vehicles, the key aspect of Pilot Project 4 was to deploy ADOT-compatible VHF radios into *all* patrol officer vehicles of each squad participating in the tests.

ADOT's SPR 569 research funding allowed sufficient equipment budget to deploy only a small-scale version of the two SPR 561 field test concepts, but up to 65 ADOT-configured VHF radios, and regional dispatch console cross-patching systems were needed. Partner funding was found within ADOT to expand the base-level deployment (20 radios) on a wider scale, to increase the potential field activity data and thus reduce the duration of the evaluation program.

In mid-2005, ADOT's Arizona Transportation Research Center (ATRC) initiated the SPR 569 project in two stages. The consultant's initial six-month Design Phase produced a deployment plan and evaluation program for the two pilot projects. This design was acceptable to all parties, and so a follow-on field hardware implementation and seven-month Evaluation Phase was initiated, which involved close monitoring of DPS and ADOT joint interoperable field tests of both the car-to-car and crosspatch concepts.

Prior to the research, the project's Technical Advisory Committee (TAC) provided guidance that the study should focus on ADOT's Flagstaff and Safford Districts. The primary method of researching the user needs was focus group interviews conducted in the Flagstaff, Phoenix and Tucson areas. Two separate meetings were held during August and September of 2005. Widespread stakeholder participation included ADOT Engineers, Maintenance Supervisors, Construction Supervisors, Hazmat and MVD representatives, and members of the TAC. The DPS stakeholders and participants included Sergeants, Lieutenants, Commanders, Dispatch Supervisors and telecommunications personnel.

These focus groups were continued as the evaluation phase progressed in 2006, with a series of three meetings held in both Tucson and Flagstaff during the study period. These discussions reviewed the interoperability incidents that were being reported on the field activity forms, and discussed possible needed changes or adjustments to the interoperability processes. As an example, minor changes in the calling procedures from an ADOT field worker to a DPS officer were implemented late in the project evaluation.

METHODOLOGY & USER NEEDS

Through initial stakeholder meetings in late 2005, and in follow-up discussions and interviews, the needs of DPS and ADOT stakeholders in two critical areas of the State were well defined. The TAC defined these critical areas of interoperability needs as those sections of I-40 and I-17 within ADOT's Flagstaff District, and along I-10 from Benson east to New Mexico in the Safford District. The I-40 / I-17 area is critical for DPS and ADOT interoperability for snow and ice control operations, and the associated accidents caused by weather conditions. To the south, I-10 is defined as critical because of high traffic volumes, blowing dust, highway flooding and occasional ice storms.

Ideally, any DPS officer should be able to communicate directly with any ADOT highway worker in these rural areas. For most pilot project communications, including accident coordination or law enforcement operations, field personnel were instructed to initiate immediate direct communications. However, for snowplowing operations, local supervisors for both agencies were to coordinate to construct a plan prior to the patrolman and plow operator having direct communications.

After the focus group meetings held in Flagstaff, Phoenix, and Tucson, it was determined that a test involving four DPS officer squads in the Flagstaff-Williams area would be involved, and also four squads in the Benson-Willcox-Bisbee-Sierra Vista areas. The formal interoperability test took place beginning May 1, 2007, after completion of hardware installation and testing, and after training of all personnel concerned was accomplished.

In the initial phase, three DPS Highway Patrol squads in the Flagstaff area and two others in the Benson-Willcox area were equipped with mid-level cost-effective Kenwood VHF mobile radios. For the next four months, they practiced interoperability with ADOT via direct radio-to-radio communications. Meanwhile, one DPS Highway Patrol squad in the Williams area, and two more in the Bisbee and Sierra Vista areas, were trying out interoperability via dispatcher crosspatching only. However, after four months, these squads doing only dispatch crosspatching were also given VHF radios, and all squads were capable of using of using either mode of interoperability for further comparisons.

OBSTACLES TO INTEROPERABILIITY TESTING & EVALUATION

The success or failure of most radio interoperability projects hinges on the quality of training provided to the users, including continued refresher training and continuous system testing. Familiarity with the system on an on-going basis is critical to success. A "train-the-trainer" plan was implemented, whereby the project consultants trained ADOT's field supervisors and TOC console operator supervisors, as well as the DPS OpCom trainers and supervisors, and field Sergeants. These people then took the training information back to their field staffs. Continued weekly testing of radios in the field, and console patching testing

at least monthly, was recommended. New employees were to be trained within 30 days of their assignment into the pilot test areas, or, to dispatch communications duty.

Evaluation of the efficiency and effectiveness of the two pilot projects depended upon the quality and quantity of the field reporting as sent back to the research team. The three feedback methods that were used included:

- Field Interviews conducted bi-monthly.

- Special dispatch log incident summaries.

- ADOT field worker / DPS officer Field Reports submitted monthly.

Data reduction was performed on the raw data to determine response times, message latency, number of field meetings required, level of confusion, frequency of interoperability technology use, and user perception of interoperability tools

By May 1, 2006, DPS had the hardware in place to begin the testing. The evaluation period ran through the end of November (7 months), with regular monitoring of the process. Three field meetings were held in both Flagstaff and Tucson to ensure that the program was running smoothly. Users were asked to send radio interoperability field report forms to the consultant on a continuing basis. After the end of the field testing, another month was needed to complete data reduction, accept any final field evaluation forms, and finalize the report.

EVALUATION RESULTS

Most of the evaluation forms received for analysis were from field users rather than console dispatch operators. As the evaluation period took place during the summer months, most of the evaluation forms came from the users in the southern region. Typical incidents cited in the forms included accidents, flooding, dust storms and road closures. There were over 40 car-to-car field user evaluation forms submitted, but only two dispatch operator forms were returned. Limited evaluation forms were received from the northern region, as there were fewer opportunities for radio interoperability

during the evaluation period. This was evident during the field user review meetings held in Flagstaff where participants indicated a general lack of circumstances that would require interoperable communications.

The results of the evaluation varied, based on the interoperability method used. Overall the general user satisfaction level for Pilot Project 4, direct car-to-car communications, was exceptionally high. Through comments received during the field review meetings and written field reports, the VHF radio user satisfaction expressed was on the order of 90%. The varying replies to the evaluation form included comments regarding improved response times to incidents, reduced confusion, better coordination between the agencies, and ease of use.

Initial contacts were successful over 90% of the time. Use of radio interoperability was found not to distract responders from their primary focus; none of the evaluation forms indicated that it interfered or interfered greatly with their regular tasks or functions. Over 85% of the responders indicated that there were absolutely no communication problems with radio interoperability. The project's TAC considered this to be a very good success rate.

One major surprise of Pilot Project 4, the direct car-to-car communications evaluation, was the extent of interoperability usage by DPS to communicate with other law enforcement and local public safety agencies in their operating area. This was *an unexpected major benefit*. Between 50% and 75% of radio interoperable communications that DPS initiated were with other law enforcement agencies, not ADOT. These other agencies included sheriff's offices, local police departments, Hazmat teams, and park rangers.

For the Pilot Project 5 test, dispatch console crosspatching, a much different result was noted. The opportunities for the intended applications of console crosspatching did not arise during the evaluation period. These would be events of long duration occurring over a wide area, such as snowstorms and large forest fires. Only two incidents were noted where a console crosspatch was successfully used, and one of the occasions

was a testing opportunity. This lack of use of the crosspatch is due to the evaluation period occurring during summer months, and in a milder than average fire season. The small number of user responses for crosspatching communications is not indicative of failure of the test, but only shows the limited number of opportunities for its use during this project's evaluation period.

OPERATIONAL RECOMMENDATIONS AND COST SUMMARY

Pilot Project 4, direct car-to-car interoperability, proved so successful and popular with DPS and ADOT personnel that an expanded statewide implementation is recommended, outside of urban Maricopa County. All participants, from field officers up through regional commanders and supervisors, agreed that the project has proven the concept, and they support its expansion. The TAC representative for the ADOT Safety and Health Emergency Response Section stated, "This is very important. We need to make this happen."

For statewide DPS implementation outside of Maricopa County, expansion of Pilot Project 4 will involve the procurement of an additional 440 radios with an approximate cost of $660,000. *This will need to be funded by DPS*, to expand beyond the ADOT research study. Legislative appropriations are one means of obtaining the necessary funding, although alternative-funding sources such as law enforcement grants should first be explored. This interoperability expansion would not replace the Arizona Interoperable Radio System (AIRS) or the future statewide Public Safety Communications Commission (PSCC) radio network, which is still at least 5 years and some $100 million in the future, but it is an efficient solution to augment the use of AIRS.

The VHF radios offer the possibility of expanding radio interoperability to neighboring states' highway departments and highway patrols, including Utah and New Mexico, and to other Arizona local agencies still using older "legacy" VHF analog radio systems.

Expansion of Pilot Project 4 would not only further enhance safety for ADOT workers and the motoring public, but also for individual DPS highway patrol officers. Any additional support available through interoperable communications will enhance the officers' safety. The perceived level of benefit from such a low cost and effort is exceptionally high for this key interagency communications issue.

It is not recommended that portable VHF radios be purchased for each DPS officer because of their limited range and the added weight on the officer's utility belt. However, one VHF portable radio could be provided for each squad in the squad office for specialized applications, including but not limited to long-term events.

Pilot Project 5 expansion is recommended on a very limited scale. Building on the Flagstaff and Tucson DPS dispatch console links, similar links should be constructed at the Phoenix DPS OpCom center. This will allow crosspatching between ADOT and DPS field units through the Phoenix DPS dispatch center, including the ADOT 800 MHz talk groups in Maricopa County. The cost of this expansion is quite minimal: approximately $3,500, based on DPS estimates. This will provide the opportunity to complete interoperable communications between DPS and ADOT both within Maricopa County and statewide. Expansion of crosspatching capability beyond these steps would be very expensive, and of questionable utility; no greater expansion of the crosspatch capability than noted above is recommended.